Feasibility Study Outline

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Initially, remedial actions associated with a list of general response actions were screened for applicability based on site and soil conditions and contaminant type. General response actions are broad categories of remedial measures that address the Remedial Action Objectives (RAOs). A response action may be a stand-alone remedial action alternative or a component of a comprehensive alternative. The list of general response actions includes:

- No Action;
- Institutional/Engineering Controls;
- Removal;

- Containment;
- *In-Situ* Biological Treatment;
- *In-Situ* Physical/Chemical/Thermal Treatment;
- *Ex-Situ* Biological Treatment; and
- *Ex-Situ* Physical/Chemical/Thermal Treatment.

This section describes the development of the cleanup action alternatives to be evaluated. The alternative development process includes identifying general response actions and corresponding technologies, screening technologies to eliminate technologies that are clearly not feasible, and assembling remaining technologies into a list of Site-specific cleanup action alternatives. This evaluation is focused on the cleanup of impacted shallow soil, as significantly impacted groundwater has not been encountered at the Property and the groundwater exposure pathways do not pose current or likely future threats to human health or the environment.

7.1 Technology Screening

Table 1 provides a screening of the general response actions together with representative remedial action technologies for soil. Based on site use and type and extent of contaminants, these remedial action technologies were screened to identify a list of technologies to include in a more detailed evaluation of potential remedial action alternatives. The results of the screening are shown in Table 1, with the shaded technologies eliminated from further consideration. Comments on the table explain the rationale for eliminating technologies from further consideration. Technologies remaining for further evaluation after the initial screening are listed below.

General Response Action	Technology
No Action	None
Institutional Controls	Deed Restrictions/Soil Management Plan/Signage Monitoring
Engineering Controls	Access Restrictions
Containment	Capping
Removal and Off-Site Disposal	Excavation Off-Site Disposal
In Situ Biological Treatment	Phytoremediation
In Situ Physical/Chemical/Thermal Treatment	Chemical Oxidation
Ex Situ Physical Treatment	Solidification/Stabilization Separation

7.2 Development of Cleanup Action Alternatives

Supporting or Supplemental Technologies. Several of the technologies retained for evaluation are only suitable for use in conjunction with other technologies and would not be considered as standalone alternatives. Several of these technologies are potentially applicable to any selected remedy and have been retained as Supporting Technologies (e.g., monitoring and inspections), and several of the technologies may only be applicable if they are deemed appropriate during implementation of the potential cleanup alternatives as Supplemental Technologies. The Supporting and Supplemental Technologies are listed below.

Supporting Technologies	Supplemental Technologies
Soil Management Plan and Deed Restrictions	Chemical Oxidation
Access Restrictions	Phytoremediation
Monitoring and Inspections	Solidification/Stabilization
	Separation

The Supporting Technologies are technologies that are applicable only in support of specific cleanup technologies, such as treatment of waste streams and are not evaluated separately but are paired with the appropriate technologies. When the specifics of these Supporting Technologies deviate from the general discussion, they will be elaborated on; otherwise, they may not be explicitly discussed in the evaluation of the alternatives.

- Off-site disposal and *ex-situ* treatment of soil are exclusively associated with excavation alternatives.

- Institutional and engineering controls may be relevant during implementation of any technology, but following implementation they would only apply to technologies where impacted soil is retained on-site (such as capping).

The Supplemental Technologies are not applicable to current Site conditions, and thus will not be incorporated into the cleanup action alternatives for evaluation. These technologies will be retained as potentially applicable technologies to address conditions that are encountered during implementation of any of the one of the cleanup action alternatives.

- In situ chemical treatment by amendment with a chemical oxidant may be used to oxidize organic and inorganic Site COCs. Complete mixing is difficult to achieve in unsaturated soils such as will be encountered at the Site, however, chemical oxidation may be a useful amendment for soils.

- Ex situ treatments by either stabilization/solidification or separation may be beneficial and/or necessary to facilitate disposal of soil excavated during construction. Stabilization/solidification involves adding an adjunct to physically or chemically bind the contaminant in order to reduce the mobility of the contaminants (e.g., leachable metals). The Site COCs are expected to be found in the soil matrix, however, during excavation, a large volume of debris may be encountered. This debris, likely consisting of metal, concrete debris and large rocks are not expected to be contaminated and Separation could be a beneficial means of physically screening or sieving of the excavated material to separate large debris from the contaminated media in order to reduce offsite disposal costs.

Cleanup Action Alternatives for Soil. The applicable primary, stand-alone cleanup technologies for soils include capping and excavation. These technologies are incorporated into cleanup action alternatives with the Supporting Technologies. The cleanup action alternatives for soil, therefore, include the following.

- No Action – This alternative is retained for comparison with other Cleanup Action Alternatives listed below.

- Excavation and Off-Site Disposal – This alternative includes the complete removal of impacted soils from the site to a licensed landfill. Depending on the waste designation, the soil would be disposed of in a Subtitle D or C landfill. Alternatively, hazardous wastes could be treated to non-hazardous conditions (e.g., through stabilization) prior to disposal in a Subtitle D landfill. This alternative fully addresses both the human health risk pathway of direct contact and the ecological risk associated with migration of erodible soils. Following excavation, the site would be backfilled with clean soil or re-graded using existing site soil. Continued monitoring would not be necessary.

- Capping – This alternative includes capping of the impacted soils using soil or pavement to prevent direct contact with or migration of impacted soil. Contaminated soils are not removed via capping and given the site contaminants, it is reasonable to assume that minimal degradation will occur. As such, implementation of deed restrictions/soil management plan to restrict access to impacted soil, signage and access control to restrict access may be required. Routine, long-term cap maintenance inspections will be necessary in perpetuity.

- Focused Excavation with Capping – This alternative includes excavation of impacted soil with higher concentrations of COCs for off-site disposal and capping remaining areas of impacted soil. As with the capping only alternative, implementation of secondary technologies associated with capping would also need to be implemented and long term cap inspections would be necessary.

- Excavation and On-Site Disposal with Capping – This alternative includes excavation of impacted soil and consolidating the soil in an on-site landfill. Selected areas could also be capped in place. Depending on the waste designation, the soil would be treated to non-hazardous conditions (e.g., through stabilization) prior to disposal. Alternatively, hazardous wastes could be disposed of off-site in a Subtitle C landfill. As with the capping only alternative, implementation of secondary technologies associated with capping would also need to be implemented and long term cap inspections would be necessary.

An *in-situ* alternative that remains in consideration as a Standby Technology is phytoremediation. Phytoremediation isn't feasible as a stand-alone technology but could be employed as a supporting technology for use with a capping technology. Utilizing phytoremediation would have the benefit of providing continued reduction of soil contaminants as removed through plant uptake, a reduction that would be unlikely with capping alone. Phytoremediation may be a suitable technology for the reducing a number of potential onsite contaminants of concern, including metals, PCBs, and PAHs. Phytoremediation could be implemented in conjunction with the intended future site use as a public green-space. With proper planning, the implemented vegetation would have the dual benefit of providing vegetation for the green-space and providing continued contaminant removal. Depending on placement and speciation, it is feasible that the use of certain types of vegetation will also provide added erosion control for the site.

These alternatives are evaluated in detail in Section 8.

8.0 DETAILED ANALYSIS OF REMEDIAL ACTION ALTERNATIVES

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Table 1
Initial Screening and Evaluation of Technologies for Soil
Port of Portland - Willamette Cove Feasibility Study

General Response Actions	Technology	Description	Screening Criteria			Screening Comments
			Effectiveness	Implementability	Cost	
NO ACTION	None	No Action	Not effective in achieving RAOs.	Easy to implement.	No capital or O&M costs incurred.	Does not meet threshold criteria. Required to be included for comparison purposes.
INSTITUTIONAL CONTROLS	Deed Restrictions/ Soil Management Plan/Signage	Can prevent disturbance of any required soil cap or other engineering controls, address notification of Site hazards, and ensure proper controls are implemented during future Site activities. Protocols will be established for handling and managing contaminated soils during future Site work to protect workers, public health, and the environment.	Effective at regulating human direct contact, but is not effective at preventing erosion or ecological exposures, and does not address contaminant reduction. Soil management plan useful for addressing future interaction with impacted soils.	Deed restriction reasonably easy to complete. Soil management plan would need to be prepared and maintained in perpetuity.	Low costs associated with implementing soil management plan and deed restrictions.	Institutional controls are useful technologies to address risks during cleanup and to address residuals remaining after primary cleanup. Would be necessary for alternatives that maintain impacted soil on-site (such as capping). Generally only applicable to human receptors.
	Monitoring	Laboratory analysis of soil samples.	Effective for documenting Site conditions to evaluate migration and current Site risks. Does not address contaminant reduction.	Moderately easy to implement. Repeat sampling events may be necessary for tracking progress of active treatment technologies, which would require multiple mobilizations.	Low to moderate costs for monitoring.	Applicable to document Site conditions and effectiveness of any treatment. Must be used in conjunction with other technologies. Would include regular inspections of implemented technology (such as capping) and erosion control.
ENGINEERING CONTROLS	Access Restrictions	Use of fencing or other controls to limit access to impacted soils.	Effective at preventing human direct contact exposure to shallow impacted soil. Not effective at preventing erosion or ecological exposures.	Reasonably easy to implement for shallow soils. Would restrict use of property.	Low costs associated with implementing controls.	Potentially applicable to the Site in limited areas. Must be used in conjunction with other technologies. Generally only applicable to human receptors
	Control of Building HVAC System	Use HVAC system to maintain positive pressure in buildings.	Not effective for inorganic or non-volatile contaminants (is used to prevent migration of volatile contaminants from soil into indoor air). Does not address migration to other media or contaminant reduction. Generally used in conjunction with other engineering controls	Not relevant to the site - no HVAC systems. Could be implemented for potential future construction.	Low implementation costs and low to moderate operation costs if used for future construction.	Not relevant to the Site under current or expected future conditions (no buildings onsite). Not effective for non-volatile contamination.
	Vapor Barriers	Installation of low-permeability barriers beneath structures to prevent vapor intrusion. Alternatively, can place sealants on floor slabs or paved surfaces.	Not effective for inorganic or non-volatile contaminants (is used to prevent migration of volatile contaminants from soil into indoor air). Does not address migration to other media or contaminant reduction.	Easy to implement for new building construction. Products readily available for sealing these surfaces.	Low to moderate cost for vapor barriers in new construction.	Not relevant to the Site under current or expected future conditions (no buildings onsite). Not effective for non-volatile contamination.
	Sub-Slab Depressurization or Sub-Floor Venting	Installation of sub-slab venting systems or suction pits to create negative pressures beneath structures to prevent vapor migration to ambient air. Vapors are collected in the suction pit or venting pipes below the building and vented to the outside of the building, either passively or with fans.	Not effective for inorganic or non-volatile contaminants. Used to prevent migration of subsurface volatile contaminants from soil into ambient air. Does not address contaminant reduction.	Easy to implement for new building construction. Materials and construction methods are readily available. Generally most suitable for buildings with slab on-grade floors.	Low to moderate cost for installation of sub-floor venting in new construction.	Not relevant to the Site under current or expected future conditions (no buildings onsite). Not effective for non-volatile contamination.
CONTAINMENT	Capping	Installation of an engineered cap (e.g., soil, asphalt, impermeable liner) over impacted soils.	Effective at preventing direct contact to contaminated soils. Does not address contaminant reduction but engineered cap can prevent erosion. Cap design can also be compatible with expected future site use.	Site is unimproved and installation of a cap would be reasonably easy. Cap design would need to account for bank erosion potential. Cap would need to be maintained in perpetuity. Cap design could be incorporated into land use design for anticipated future use.	Moderate to high construction cost for installation of cap. Low to moderate costs for ongoing maintenance of cap to maintain effectiveness.	Potentially applicable to the site to prevent direct contact and prevent bank erosion. Specific technology used would have to be compatible with future expected use (e.g., expansive asphalt concrete cap is not applicable, but a lined soil cap with strategically placed paved trails may be).
REMOVAL/OFF-SITE DISPOSAL	Excavation	Excavation of some or all of the contaminated soil for subsequent treatment and/or disposal. Focused excavation may include only higher concentrations or "hot spot" soil.	Effective for removing source material from site. Addresses direct exposure pathways and migration by reducing contaminant concentrations and mass. Restoration of the property would require backfill with treated soil or imported fill.	Implementation involves conventional construction equipment and methods. Integration into land use plan would be feasible.	Moderate to high costs due to required soil volumes.	Applicable to the site.
	Off-site Disposal	Off-site disposal of excavated soil at licensed disposal facility. Soils would require waste profiling and approval by the disposal facility.	Effective for containing contaminated soils and reducing risks associated with direct exposure.	Implementation involves transportation of contaminated soils on public roads. Non-soil wastes (rock and debris) may be separable to reduce disposal volume.	Moderate to high costs depending upon soil volumes and characterization.	Applicable to the site.

Please refer to note at end of table.

Table 1
Initial Screening and Evaluation of Technologies for Soil
Port of Portland - Willamette Cove Feasibility Study

General Response Actions	Technology	Description	Screening Criteria: Effectiveness	Screening Criteria: Implementability	Screening Criteria: Cost	Screening Comments
IN SITU PHYSICAL/ CHEMICAL/ THERMAL TREATMENT	Soil Vapor Extraction (SVE)	SVE involves extraction of vapors from the vadose zone using system of vertical wells or horizontal vents and vacuum pumps/blowers. Treatment of the discharge may be required.	Not effective for inorganic or non-volatile contamination.	Not applicable for treatment of inorganic or non-volatile contaminants. Would use well-established technologies and implementation is straightforward, but implementation would be ineffective	SVE system would have moderate capital and O&M costs.	Not suitable for Site conditions (shallow soils) and target contamination (inorganics and non-volatiles).
	Electrokinetic Separation	Application of a low-intensity direct current through the soil between electrodes that are divided into a cathode array and an anode array. This mobilizes charged species, causing ions and water to move toward the electrodes.	Effective for removing inorganic ions and polar organics from saturated soil. Most effective in low-permeability soils (particularly clays). Not effective for vadose zone soil without supplemental saturation. Not effective for all contaminants.	Requires significant power supply and would require saturation of shallow soils over large area.	Very high implementation cost.	Not suitable to Site conditions (unsaturated soil). Would not address all contamination and would result in high expense with no benefit.
	Fracturing	Development of cracks in low-permeability or overconsolidated soils to create passageways that increase the effectiveness of other *in situ* processes and extraction technologies.	Effective in conjunction with other technologies (e.g., vapor extraction) in deep, fine-grained or consolidated soils. Not effective with shallow soil.	Specialized equipment and personnel needed to safely implement.	Moderate implementation cost.	Not suitable for Site conditions (shallow soil and inorganic contaminants).
	Chemical Oxidation	Chemically converts hazardous contaminants to less toxic compounds. Effective in destroying organic contaminants and oxidizing inorganic contaminants to less toxic/less mobile forms. Can include oxidant chemicals such as peroxides, permanganates, or ozone.	Can be highly effective at destruction of organic contaminants or oxidation of inorganics. Can be difficult to achieve full coverage (contact between oxidant and COIs), particularly in unsaturated soils.	Equipment and vendors are readily available. Delivery difficult in unsaturated soils.	High to Very High implementation cost.	Potentially applicable via blending of oxidant into shallow soil. Potentially effective for addressing organic contaminants, but benefit to inorganic contaminants would need to be determined (assessment of specific reaction chemistry to determine potential reduction in mobility/toxicity). High cost and significant material handling effort likely required.
	Soil Flushing	Water (or water containing an additive to enhance contaminant solubility) is circulated through the soil to desorb contaminants, recovered, and treated. Implementation can involve injection followed by removal (such as via vacuum truck)	May be effective for soluble inorganics but would require groundwater extraction/treatment operation and ongoing saturation of vadose zone treatment area.	Difficult to maintain control of amended water. Inefficient process for unsaturated soils.	High implementation cost.	Not retained because less effective in shallow unsaturated zone. Would require significant infrastructure for water extraction and treatment. High associated cost.
	Solidification/ Stabilization/ Vitrification	Contaminants are physically bound or enclosed within a stabilized mass (solidification and vitrification), or chemical reactions are induced between the stabilizing agent and contaminants to reduce their mobility (stabilization).	Potentially suitable to reducing mobility of and accessibility to site contaminants. Difficult to ensure complete enclosure of soil with in-situ process.	Difficult to obtain full stabilization in-situ in heterogeneous subsurface by injection. Vitrification would require significant power supply. Finished product would not be compatible with anticipated future site use.	High to very high implementation cost.	Not retained because less suitable to Site conditions and high cost.
	Thermally-Enhanced Removal	High-energy injection (steam/hot air, electrical resistance, electromagnetic, fiber optic, radio frequency) is used to increase the recovery rate of semi-volatile or non-volatile compounds to facilitate extraction (enhanced volatilization or decreased viscosity).	Most suitable to semi-volatile organic contaminants or viscous compounds that are not otherwise extractable with vapor extraction or fluid extraction technologies.	Generally used in conjunction with SVE system or other recovery system (i.e., groundwater extraction). Has high energy requirements. Not applicable for treatment of inorganic contaminants.	High implementation cost.	Not effective for inorganic contamination.
IN SITU BIOLOGICAL TREATMENT	Bioventing	Bioventing involves inducing air or oxygen flow in the unsaturated zone to promote biodegradation of hydrocarbons and VOCs. Applications include injection of air or oxygen into subsurface, or extraction of air at rates lower than SVE.	Not effective with inorganic contaminants. Degradation of site-specific organic COCs expected to be very slow.	Not applicable for treatment of inorganic Site contaminants. Would use well-established technologies and implementation is straightforward, but implementation would be ineffective.	Low to moderate capital and O&M costs.	Not effective for inorganic contamination.

Please refer to note at end of table.

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General Response Actions	Technology	Description	Screening Criteria			Screening Comments
			Effectiveness	Implementability	Cost	
IN SITU BIOLOGICAL TREATMENT—CONTINUED	Enhanced Bioremediation (Bioaugmentation, Biostimulation)	Adding nutrients, electron acceptor, or other amendments to enhance bioremediation.	Most effective with organic contaminants, but can be used to change oxidative state of inorganics. Can be difficult to achieve full coverage (contact with COIs), particularly in unsaturated soils.	Would require saturation of treatment area, and would be inefficient for stabilization of target COIs.	Low to moderate costs depending on number of injection events required.	Not suitable for shallow unsaturated soil and would have marginal benefit (if any) to site contaminants. Any benefit would be slow to complete and would not be compatible with anticipated future site use in the meantime.
	Land Treatment	Combination of aeration (tilling) and amendments to enhance bioremediation in surface soils.	Effective for organic contaminants in shallow soil that can be degraded aerobically. Not effective for deeper contamination or inorganics.	Common agricultural equipment can be used to process shallow soil. Not applicable for treatment of inorganic contaminants.	Low to moderate implementation cost.	Not retained because incompatible with Site contamination and depth to contaminants. Similar application with potentially viable additives (i.e., oxidants) covered under chemical oxidation alternative.
	Monitored Natural Attenuation	Using natural processes to reduce contaminant concentrations to acceptable levels. Process is closely monitored to verify exposures are acceptable prior to concentrations reaching acceptable levels	Most effective with organic contaminants, but natural processes can change oxidative state of inorganics. Likely unable to effect change in unsaturated soils.	Easy to implement. Monitoring of unsaturated soil would require repeated intrusive sampling events. Implementation would likely be ineffective.	Moderate costs for monitoring.	Not retained because ineffective with Site contaminants and conditions (i.e., shallow unsaturated soil).
	Phytoremediation	Phytoremediation is a process that uses plants to remove, transfer, stabilize, and destroy contaminants in soil or sediment.	Can be effective at removing a variety of organic and inorganic compounds from soil through plant uptake in vicinity of roots (rhizosphere).	Requires significant land area suitable for large plants. Contamination must be accessible to plant root zones. May be compatible with anticipated future site use, but management of plants and plant debris would be needed.	Low to moderate implementation cost.	Potentially suitable for some of the Site contaminants of concern in conjunction with other primary technologies such as excavation and/or capping, and would be compatible with future Site use. Is not considered a feasible stand-alone technology. Potentially suitable for inorganic contaminant removal and degradation/stabilization of some Site organic contaminants (i.e. PCBs and PAHs).
EX SITU PHYSICAL/ CHEMICAL/ THERMAL TREATMENT	Chemical Extraction	Excavated soil is mixed with an extractant, which dissolves the contaminants. The resultant solution is placed in a separator to remove the contaminant/extractant mixture for treatment.	Most suitable to removal of semi-volatile and inorganic contamination from excavated soil. Extracted solute/contaminants would be disposed of as a concentrated waste and treated soil could be reused as backfill.	Can be effective in removing most organic or soluble inorganic contaminants from soil. Difficult to remove all contaminant/extractant mixture from soil—would likely require finish treatment. Requires area for soil treatment or transport to off-site facility. Extractant fluid would need subsequent treatment process or disposal.	High implementation cost.	Not retained for excavated soil as significant additional cost over soil disposal with insufficient benefit (treatment costs higher than disposal costs).
	Solidification/ Stabilization	Contaminants are physically bound or enclosed within a stabilized mass (solidification), or chemical reactions are induced between the stabilizing agent and contaminants to reduce their mobility (stabilization).	Potentially suitable to reduce leaching of contaminants prior to disposal.	Could be used to solidify wet soil or stabilize inorganics if needed for acceptance of excavated soil at the disposal facility.	Low to Moderate implementation cost.	Retained as potentially applicable to soil fraction of excavated soil if stabilization has benefit for disposal.
	Dehalogenation	Reagents are added to soils contaminated with halogenated organics to remove halogen molecules.	Effective at detoxifying halogenated organic compounds in excavated soil. Not applicable to inorganics or non-halogenated COCs.	Requires mixing of reagents (in on-site process or off-site plant). Likely requires further treatment or disposal of processed soil.	Moderate to high implementation cost.	Not retained because incompatible with Site contaminants.
	Incineration	High temperatures are used to combust (in the presence of oxygen) organic constituents in hazardous wastes.	Effective at removing organic contaminants from excavated soil. Not applicable to inorganics (though can change the oxidative state).	Requires transport to off-site facility (long-distance interstate transport—nearest facility in Nebraska, distance of 1,200 miles). Not applicable to site contaminants.	High implementation cost.	Not retained because incompatible with Site contaminants.
	Soil Washing	Contaminants are separated from the excavated soil with wash-water augmented with additives to help remove organics.	Most suitable to removal of semi-volatile and inorganic contamination from excavated soil. Extracted solute/contaminants would be disposed of as a concentrated waste and treated soil could be reused as backfill.	Requires area for soil treatment or transport to off-site facility. Resultant fluid would need subsequent treatment process or disposal.	Moderate to high implementation cost.	Not retained for excavated soil as significant additional cost over soil disposal with insufficient benefit (treatment costs higher than disposal costs).
	Solar Detoxification	Contaminants are destroyed by photochemical and thermal reactions using ultraviolet energy in sunlight or artificial UV light. Usually involves application of catalyst agent.	Can be effective at treating a variety of organic compounds. Not applicable to inorganics.	Implementation with sunlight limited by availability (not effective during nighttime and limited effectiveness in cloudy/wet seasons). Not applicable to site contaminants.	Low to moderate implementation cost.	Not retained because incompatible with Site contaminants. Long-term process not compatible with anticipated future site use during implementation.
	Thermal Desorption/ Pyrolysis/ Hot Gas Decontamination	Waste soils are heated to either volatilize (desorption and hot gas) or to anaerobically decompose (pyrolysis) organic contaminants. Off-gas is collected and treated.	Effective at removing organic materials from excavated soil (particularly volatile organics). Pyrolysis generally used for semi-volatiles or pesticide wastes. Would not be effective for inorganics.	Not applicable to treatment of inorganic contaminants.	Moderate to high implementation cost.	Not retained for excavated soil as incompatible with inorganic COCs and significant additional cost over soil disposal with insufficient benefit (treatment costs higher than disposal costs).

Please refer to note at end of table.

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General Response Actions	Technology	Description	Screening Criteria: Effectiveness	Screening Criteria: Implementability	Screening Criteria: Cost	Screening Comments
EX SITU PHYSICAL/ CHEMICAL/ THERMAL TREATMENT—CONTINUED	Separation	Separation techniques concentrate contaminated solids through physical, magnetic, and/or chemical means. These processes remove solid-phase contaminants from the soil matrix.	Effective for removal of solids with distinct physical characteristics (size, composition, etc.).	Commercial equipment available for separation by size (sieving) or for removing iron (magnetic removal).	Low to moderate cost.	May be potentially applicable for removal of rock fraction and debris from excavated soil prior to offsite disposal (reducing disposal volume). Not expected to directly separate contaminants.
EX SITU BIOLOGICAL TREATMENT	Biopiles	Excavated soils are mixed with soil amendments and placed in aboveground enclosures and aerated with blowers or vacuum pumps.	Effective for removal of organic contaminants from excavated soil. Would not be effective for inorganics and organic COCs would likely react slowly to process.	Not applicable to treatment of inorganic contaminants.	Low to moderate cost.	Not retained because incompatible with Site contaminants. Long-term process not compatible with anticipated future site use during implementation.
	Composting	Excavated soil is mixed with bulking agents and organic amendments to promote microbial activity.	Effective for removal of organic contaminants from excavated soil. Would not be effective for inorganics and organic COCs would likely react slowly to process.	Not applicable to treatment of inorganic contaminants.	Low to moderate cost.	Not retained because incompatible with Site contaminants. Long-term process not compatible with anticipated future site use during implementation.
	Landfarming	Excavated soil is placed in lined beds and periodically tilled to aerate the soil.	Effective for removal of organic contaminants from excavated soil. Would not be effective for inorganics and organic COCs would likely react slowly to process.	Not applicable to treatment of inorganic contaminants.	Low to moderate cost.	Not retained because incompatible with Site contaminants. Long-term process not compatible with anticipated future site use during implementation.
	Slurry Phase Biological Treatment	An aqueous slurry of soil, sediment, or sludge with water and other additives is mixed to keep solids suspended and microorganisms in contact with the soil contaminants. When complete, the slurry is dewatered and the soil is disposed of.	Effective for removal of organic contaminants from excavated soil. Would not be effective for inorganics and organic COCs would likely react slowly to process.	Not applicable to treatment of inorganic contaminants. Would require significant infrastructure for treatment and management of soil volume.	Moderate to high implementation cost.	Not retained because incompatible with Site contaminants. Long-term process not compatible with anticipated future site use during implementation.

Note:
1. Shading indicates technology has been eliminated from consideration.